IMPROVEMENTS IN OR RELATING TO TUBE COUPLINGS

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to tube couplings.

2. Background Prior Art

UK-A-1520742 discloses a "Speedfit" connector comprising a coupling body with a throughway open at one end and a tapered cam surface in the open end to receive a collet for locking a tube in the coupling. The collet is compressed against the tube by a slight withdrawal of the tube/collet from the coupling body which locks the tube in the coupling body. The collet can be depressed into the body to release the tube when required.

UK-A-2167147 discloses a "SuperSeal" connector which is a modification of the "Speedfit" connector and has a separate sleeve screwed into the open end of the coupling body in which the tapered cam is formed. By screwing the sleeve into the coupling body the gripping action of the collet on the tube is increased. Also the collet becomes locked up in the coupling body and cannot be depressed to release the tube. The tube is then permanently locked in the coupling body.

EP-A-0945662 discloses a tube coupling having both "Speedfit" and SuperSeal" modes of operation. More particularly the coupling comprises a coupling body having a throughway open at one end to receive an end portion of a tube and having an internal cam surface tapering towards the open end in which a collet is located for locking the tube in the coupling body by engagement with the tapered cam surface and having stop means to limit entry of the collet into the throughway. The coupling body has a main portion, the throughway of which receives the end of the tube and

contains said stop means to limit insertion of the collet and an end cap in screw threaded engagement with the main body. The end cap provides said open end to the throughway and the tapered cam surface. Indexing means are provided between the end cap and the main body to define different positions of rotation of adjustment in the first of which the tube can be inserted in and by depressing the collet into the coupling body, released in the coupling body (i.e. "Speedfit" mode) and in the second of which the collet is engaged with the stop means to prevent the collet being depressed into the coupling body to release the tube (i.e. "SuperSeal" mode).

There is a need to provide an alternative construction to achieve both "Speedfit" and "SuperSeal" functions whilst simplifying manufacture and assembly.

SUMMARY OF THE INVENTION

This invention provides a tube coupling comprising a coupling body having a throughway open at one end to receive an end portion of the tube and having an internal cam surface tapering towards the open end in which a collet is located for locking a tube in the coupling body by engagement with the tapered cam surface, and having stop means limit entry of the collet into the throughway, the coupling body having a main body portion the throughway of which receives the end of the tube and contains the stop means to limit the insertion of the collet and an end cap in screw threaded engagement with the main body portion having an open end into the throughway and the tapered cam surface, wherein detent means are provided acting between the end cap and the main body portion which are engaged by screwing the cap onto the body past a first position in which a tube can be inserted through the collet into the coupling body and released from the coupling body by depressing the collet into the body, the detent means permitting the cap to be

screwed further onto the body to a second position in which the collet is held by the cap in engagement with the stop to prevent the collet means pressed to release the tube engaged in the collet.

The arrangement removes the cams from both the cap and body. Instead, in a preferred embodiment the body has a thin, flexible, flange or "diaphragm" protruding radially from the body's outside diameter. The cap has an internal slot, similar to a circlip groove. As the cap is assembled onto the body the cap butts against the diaphragm and bends away as the cap passes beyond. Thereafter, the diaphragm snaps into the groove but due to the groove's major diameter cannot flex back to its original position - it is always bent in the direction opposing any removal of the cap from the body.

With this arrangement the diaphragm is snap engaged in the slot with longitudinal movement of the cap along the body. The cap's position is constrained lengthwise by the end of the cap butting against the large inflexible flange on the body or by the flexible diaphragm opposing and butting against the end of the groove in the cap.

The design as shown in the attached drawings also has a tapered major groove diameter in the cap. This taper allows the diaphragm to expand as the cap is screwed further onto the body thereby reducing friction between the two and providing the user with better tactile feed back. This encourages the user to maintain the two preferred positions for the cap in use: either extreme for "Speedfit" or "SuperSeal" are not somewhere in between.

Preferably, stop means are provided for acting between the cap and main body portion limiting the extent to which the cap can be screwed onto the body portion to define the second position of the cap on the body portion.

More specifically, the stop means comprise a raised abutment on the main body portion located in the path of the

cap as it is screwed onto the body portion to be engaged by the cap when the cap reaches its second position on the body portion.

In the latter arrangement, the raised abutment on the coupling body portion may be an annular abutment which is engageable with the leading end of the cap as the cap is screwed onto the coupling body.

In any of the above arrangements, the detent means acting between the cap and coupling body may comprise a radially outwardly projecting detent formed on the coupling body engageable with a slot formed in a cap.

More specifically, the detent may comprise an annular resilient flange or diaphragm projecting radially outwardly of the coupling body and the cap may have an annular slot encircling an inner side of the cap in which the annular flange is engageable, the slot having a width sufficient to allow the cap to move between said first position in which the flange is located at one end of the slot and prevents the cap from withdrawal from the coupling body and said second position in which the flange is located towards the other end of the slot.

By way of example the annular slot may be spaced away from the leading end of the cap in the direction in which the cap is located on the coupling body and a portion of the cap between the slot and under the cap may be adapted to deflect the flange as the cap is screwed onto the coupling body until the flange reaches and snaps into the slot.

In the latter case the slot and the flange may be dimensioned so that the flange is held in the slot bent over towards the leading end of the cap so that when the cap is unscrewed from the second position to the first position, the flange will engage the end of the slot in the first position and resists further withdrawal of the cap from the coupling body.

Furthermore, the bottom of the slot may converge with the coupling body towards the leading end of the cap so that as the cap is screwed onto the coupling body to the first and second positions, so that the extent to which the flange is deflected by engagement with the bottom of the slot reduces.

BRIEF DESCRIPTION OF THE DRAWINGS

The following is a description of some specific embodiments of the invention, reference being made to the accompanying drawings in which:

Figure 1 is a cross-sectional view of a tube coupling in accordance with the invention including a tube inserted in the coupling;

Figure 2 is a detailed view of part of a coupling body of the tube coupling;

Figure 3 is a cross-sectional view through part of the tube coupling showing a cap on the coupling body in the first "Speedfit" position; and

Figure 4 is a cross-sectional view through part of the coupling body showing the cap in the second "SuperSeal" position, and

Figures 5 shows a modified form of the end cap of the coupling body.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring firstly to Figure 1 of the drawings, there is shown a moulded plastics tube coupling body indicated generally by reference numeral 10 having a throughway 11 open at one end 12 to receive an end portion of a tube 13. The coupling body comprises a main body portion 10a and an end cap 10b screwed onto the main body as described below.

At a location spaced from the open end, the throughway in the main body has a first increase in diameter at a step 14 to provide an enlarged bore 15 in which the end of the

tube 13 is a close sliding fit with the end of the tubing engaging the step 14. The throughway has a further increase in diameter at a step 16 to form an enlarged bore 17 in which an 'O' ring seal 18 is located against the step followed by a spacer washer or compression ring 19.

The main body portion 10a of the coupling has an external screw-threaded section 20 extending from the end of the body part followed by a plain section in which a detent is formed as described later and followed in turn by an encircling radial flange 22. The end cap 10b of the coupling body encircles the main body and has an internal feature for engaging with the detent on the main body portion again as described later.

A collet indicated at 25 is mounted in the open end of the coupling body comprising an annular member 26 and resilient arms 27 projecting from the annular member into the throughway of the coupling body and terminating in heads 28. The heads of the collet engage in a tapered cam surface 29 converging towards the end of the coupling body to be compressed against the tube 13 by engagement of the heads with the cam surface to lock the tube in the coupling body.

Reference is now made to Figure 2 of the drawings which is a cross-sectional view through part of the main body portion 10a. Between the end of the screw threaded section 20 on the main body and the flange 22 there is an upstanding annular flexible diaphragm 30 formed integrally with the body. The diaphragm forms part of the detent arrangement referred to above for engaging with and locking the cap on the body as described below.

The end flange 22 has an abutment face 32 to provide an end stop for the cap when the latter is fully screwed onto the coupling body as described below.

Turning now to Figure 3 of the drawings, the end cap 10a is shown partially screwed onto the body to a first position in which the collet in the cap receives and holds a

tube in the coupling body in the "Speedfit" manner. That is to say, the tube is locked in the coupling body but can be released by depressing the collet into the coupling body to release the gripping engagement of the collet with the tube and allow the tube to be withdrawn.

The inner side 34 of the end of the cap is formed on with an encircling slot 35, in which the annular diaphragm 30 is engageable. The mouth of the cap has a bevelled entry indicated at 36 to assist in deflecting the diaphragm as the cap is screwed onto the body and the diameter of the mouth of the cap leading is slightly greater than the rest of the inner diameter of the cap to facilitate entry of the diaphragm into the slot. Screwing the cap onto the body sufficiently to engage the diaphragm to engage the end of the slot nearest the mouth of the cap locates the cap in the first "Speedfit" position referred to above. The bottom wall 37 of the slot is tapered to reduce in diameter towards the open end of the cap so that the diaphragm is held bent over towards the side of the slot adjacent the mouth of the slot. Thus, the diaphragm is held in engagement in the corner formed between the bottom wall of the slot and the side wall of the slot when the cap is rotated in the direction to withdraw from the main body to prevent withdrawal of the cap from the main body portion beyond the first position.

As the cap is screwed further onto the body, the diaphragm rides up the tapering undercut of the bottom wall of the slot in the cap relaxing the diaphragm slightly, and therefore reducing the resistance to rotation of the cap. The cap can then be screwed onto the body until it engages the upstanding end flange 22 of the coupling body as indicated in Figure 4 in which the cap is in the second or "SuperSeal" position. The collet is then held in engagement with the end stop in the coupling body and cannot be

depressed to allow a tube to be released from the coupling body.

The arrangement thus provides a tube coupling body which is readily assembled and which provides both "Speedfit" and "SuperSeal" functions without unduly stressing the components of the body.

A number of further embodiments in the invention are also envisaged as follows:

This design can also be used on metal coupling bodies or rigid plastic coupling bodies in which case the flexible diaphragm could be moulded on a separate split ring which is assembled into a groove or recess on the body between the thread and the large flange so that the detent engages in the slot on the cap.

Equally the separate split ring could be mounted in the cap with the diaphragm with the flexible diaphragm projecting radially inwardly to engage in a slot in the main body portion.

The slot or groove in the body portion would be located between the thread and the large flange. Again, the slot or groove in the body could have a tapered major diameter.

In all of the designs above the diaphragm could be interrupted once or several times to allow for tooling or to allow the diaphragm's resilient/flexible characteristics to be optimised.

In accordance with the further modification, an enlarged groove 30 is formed at the end of the slot remote from the open end of the cap as illustrated in Figure 5. When the cap is rotated provisionally to move the diaphragm into this position, the cap is in a non-load imposing position and thereby allowing easy threading.